Close Window

2010 AGU Fall Meeting

You may print by clicking on this Print *button. To return to the previous page, close this browser window or click the 'X' button in the top right corner of the page.*

ID# V23A-2384
Location: Poster Hall (Moscone South)
Time of Presentation: Dec 14 1:40 PM - 6:00 PM

Modeling CO2 air dispersion from gas driven lake eruptions (*Invited*)

G. Chiodini[1]*; A. Costa*[1]*; D. Rouwet*[2]*; F. Tassi*[3]
1. INGV, Napoli, Italy.
2. INGV, Palermo, Italy.
3. University, Florence, Italy.

The most tragic event of gas driven lake eruption occurred at Lake Nyos (Cameroon) on 21 August 1986, when a dense cloud of CO2 suffocated more than 1700 people and an uncounted number of animals in just one night. The event stimulated a series of researches aimed to understand gas origins, gas release mechanisms and strategies for gas hazard mitigation. Very few studies have been carried out for describing the transport of dense CO2 clouds in the atmosphere.
Although from a theoretical point of view, gas dispersion can be fully studied by solving the complete equations system for mass, momentum and energy transport, in actual practice, different simplified models able to describe only specific phases or aspects have to be used. In order to simulate dispersion of a heavy gas and to assess the consequent hazard we used a model based on a shallow layer approach (TWODEE2). This technique which uses depth-averaged variables to describe the flow behavior of dense gas over complex topography represents a good compromise between the complexity of computational fluid dynamic models and the simpler integral models.
Recently the model has been applied for simulating CO2 dispersion from natural gas emissions in Central Italy. The results have shown how the dispersion pattern is strongly affected by the intensity of gas release, the topography and the ambient wind speed.
Here for the first time we applied TWODEE2 code to simulate the dispersion of the large CO2 clouds released by limnic eruptions.
An application concerns the case of the 1986 event at lake Nyos. Some difficulties for the simulations were related to the lack of quantitative information: gas flux estimations are not well constrained, meteorological conditions are only qualitatively known, the digital model of the terrain is of poor quality. Different scenarios were taken into account in order to reproduce the qualitative observations available for such episode. The observations regard mainly the effects of gas on the people living in the surrounding areas. Simulation results are in good agreement with these observations.
Another application is focused on a hypothetical gas release from lake Albano (Italy), a volcanic lake that probably degassed on the past as reported in historical chronicles by the Roman historian Titus Livius. At the present time the lake is far from saturation conditions and the occurrence of such an event is impossible. However a recent re-interpretation of literature data clearly show the presence of anomalous CO2 enrichment of the lake waters during the last seismic crisis which affected the area. For these reasons a future limnic eruption can not be ruled out completely. The simulations we present show the potential effect of a gas driven eruption from lake Albano in this densely populated area located 20 km south-east from the centre of Rome.

Contact Information
Giovanni Chiodini, Napoli, Italy, 80124, click here to send an email